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ABSTRACT

Eighty sixth-grade subjects, split into five independent groups, learned two PA lists of 12 noun pairs each. Two groups performed under traditional transfer conditions with lists conforming to a negative transfer paradigm, A-B, A-C, or to a reference paradigm A-B, C-D. Two other groups learned the same lists under a syntactic PA method where the pairs were embedded in sentences. A fifth group performed in an A-B, A(S)-C paradigm where the items of A-B, A-C were embedded in sentences that changed the meaning of the stimulus terms. The results showed that negative transfer is significantly reduced when items are placed in sentences. Also, the specific effects associated with A-B, A(S)-C showed marked negative transfer on the first trial of list two learning. (Author)

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# SEMANTIC EFFECTS IN TRANSFER

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# SEMANTIC EFFECTS IN TRANSFER[1]

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Studies examining the effects of syntax on the acquisition of single list paired-associate (PA) learning have provided important information about linguistic processes (Davidson & Dollinger, 1969; Rohwer, 1966; Rohwer & Levin, 1968). The method of syntactic PA learning has also been useful in examining the interaction of language with a number of subject variables: learning ability (Davidson, 1964); retardation (Jensen & Rohwer, 1963; Milgram, 1967); socioeconomic status (Rohwer, 1968). The present research extends the method to the study of transfer.

Specific transfer effects in verbal learning may be positive or negative depending on the relationships that exist between the stimulus and response terms in successive lists. Thus, it is known that negative transfer occurs in the A-B, A-C paradigm where new responses are paired with old stimuli. To evaluate the specific transfer effects, comparisons are made to a reference paradigm, A-B, C-D where successive lists are made up of unrelated stimuli and unrelated responses. In the present study, these two paradigms were used to evaluate the specific transfer effects of a third paradigm, A-B, $A^S$-C, where orthographically identical stimuli are modified semantically by selecting appropriate adjectives.

As an example of the A-B, $A^S$-C paradigm, consider the following manipulations in first list acquisition: the Subject learns the pair, driver-pole in the sentence context, "The pile driver sunk the pole". The S is then transferred to a second list where he learns the pair driver-ticket in the context, "The woman driver paid the ticket". In traditional PA learning (without syntax) these manipulations define the A-B, A-C paradigm and negative transfer would likely occur. How would the addition of syntax alter the transfer effects?

Typically, syntax markedly facilitates single list PA learning. In PA transfer, the powerful facilitating effect of sentence contexts may produce some general and substantial list differentiation in first and second list learning and thereby reduce negative transfer. An experiment by Schwenn and Davidson (1969) offers some support for this possibility. It was found that the addition of sentence context in second list learning reduced, but not completely, negative transfer in A-B, A-C relative to A-B, C-D. The present experiment provides another test of general list differentiation by imposing sentence contexts on first and second list learning. In addition, the paradigm A-B, $A^S$-C offers a test of a specific list-differentiation effect. That is, while the stimuli of the first and second list are orthographically identical, their conceptual or semantic character has been changed, and it is possible that the change in meaning of the stimulus terms would make the A-B, A-C paradigm more A-B, C-D in nature.

## Method

### Subjects

Eighty sixth-grade children from two schools in a semirural public elementary school district were recruited for the experiment. Sixteen Ss were assigned at random to each of the experimental conditions, and the proportions of Ss from the two schools were approximately equal across conditions.

### Experimental Conditions and Materials

Five experimental treatments were administered. Three of these manipulated the PA items in a sentence context which conformed to the following transfer paradigms: A-B, A-C/Sentence (hereafter AC/S); A-B, $A^S$-C/Sentence ($A^SC/S$); and A-B, C-D/Sentence (CD/S). The items were manipulated also under traditional PA transfer methods, and the paradigm, A-B, A-C/PA (AC/PA) refers to such a condition. The paradigm A-B, C-D/PA (CD/PA) was the fifth experimental condition.

The learning materials consisted of lists of 12 pairs of nouns with frequencies from 2 to AA (Thorndike & Lorge, 1944). All lists shared equally words of the varying frequencies. This was true with respect to both the stimulus and response pairs and the sentence contexts in which they were embedded. The to-be-learned pairs were typed in lower case and underlined. The sentence contexts were all simple past tense declaratives with the paired nouns functioning as subject and direct object. The initial article was capitalized and the sentence ended with a period. Five random orders of the lists were prepared. All groups learned the same second list.

Examples of the learning materials for the five conditions are shown below:

| | List 1 | List 2 |
|---|---|---|
| AC/S | The hard ball hurt the girl. | The hard ball hit the fence. |
| $A^{S}C/S$ | The fireman's ball pleased the girl. | The hard ball hit the fence. |
| CD/S | The hickory stick hurt the girl. | The hard ball hit the fence. |
| AC/PA | ball girl. | ball fence. |
| CD/PA | stick girl. | ball fence. |

Procedure

The Ss participated individually. Prior to first list learning the task was described, and Ss were given practice from a booklet containing items naming goemetric figures or numerals. In the case of PA practice the items were simply paired and underlined. For the sentence context conditions, the practice items were placed in a conjunction phrase.

The learning materials were presented on an MTA-100 Scholar using the study-test method. The rate was 4.5 sec. for both the study and test portions of each trial, with a 4.5 sec. intertrial interval. First list learning criterion was 11/12, and the second list was presented for five study-test trials. The interlist interval was 1 min.

On the study portion of the first trial for both list one and list two, S was instructed to read silently while the E read aloud. Subsequently, the S was to read aloud the items or sentences as they

appeared. For the test portion of each trial, S was told specifically that he should try to supply the second underlined word upon presentation of the first. Sentence contexts were removed during test.

## Results and Discussion

List 1, Acquisition. The mean numbers of trials to a criterion of 11/12 and mean percentages of errors in first list learning are presented in Table 1. Contrary to usual findings, the sentence

Insert Table 1 about here

contexts did not differentially facilitate acquisition as compared to the traditional PA method. An F-statistic for an orthogonal contrast of Sentence vs. PA paradigms on the trials to criterion measure was not significant ($F < 1$). No other comparison among paradigms was significant.

The finding of no sentential facilitation of PA learning might be attributed to the procedures and materials used. The Ss were required to read printed sentences during the study portion of every trial. Rohwer, Lynch, Levin and Suzuki (1967) observed a substantial, though not complete, reduction in sentential facilitation of PA learning when noun pairs were printed words as opposed to pictured objects. The Ss in the experiment were not required to read, nor did they see, the sentence context materials. Yuille and Pritchard (1969) reported no sentential facilitation of PA learning where stimulus materials, including sentence contexts, were printed on

cards and read by the E. Errors analyses were not reported in the two experiments above, but such analyses might provide information concerning this matter.

List 1 Errors. Percentages of errors during list 1 learning are based on opportunities (total presentations minus correct responses). Error rates among the paradigms were tested following arcsine transformation. For total errors, a univariate analysis of variance revealed no differences ($F < 1$); however a multivariate analysis of variance was applied to the stimulus intrusion and misplaced response measures.[2] One contrast from an orthogonal set of four was statistically significant. It was a Sentence vs. PA paradigm orthogonal contrast ($F = 6.54$, $df = 2/74$, $p < .01$). An examination of the associated univariate statistics indicated that the PA paradigms produced significantly more misplaced responses ($F = 13.26$, $df = 1/75$, $p < .001$), while being essentially equal to the sentence conditions in stimulus intrusion errors ($F < 1$). Thus, while the total error rate in the PA paradigm was largely accounted for by stimulus intrusions and misplaced responses, these types of errors constituted a relatively small proportion of the total error rate in the sentence paradigm. These results suggest that the procedure of requiring Ss to read the printed sentence materials encouraged large numbers of importations during the test portions of each trial. Inspection of the protocols showed all paradigms to be approximately equal in extralist intrusions; thus, the importations

in the three sentence groups were of an intralist variety, and their source was the sentence context elements--adjectives and verbs. The end result was that list 1 acquisition under the sentence context conditions was vitiated.

List 2 Acquisition. Acquisition curves for the five experimental conditions in list 2 learning are presented in Figure 1.

Insert Figure 1 about here

An orthogonal set of four comparisons was formed and tested by multivariate analysis of variance with trials entered as variates. Two of the four contrasts were significant. One of these pitted the AC/S against $A^{S}C/S$ ($F = 2.60$, $df = 5/71$, $p < .05$), and the other contrasted AC/PA with CD/PA ($F = 2.41$, $df = 5/71$, $p < .05$). The univariate statistics associated with the former contrast (Trial 1, $F = 5.43$, $df = 1/75$, $p < .05$) and an inspection of the means of Figure 1 indicate that the locus of the effect was at Trial 1. Further, and contrary to prediction, the experimental manipulations favored the AC/S condition by producing less negative transfer relative to $A^{S}C/S$. Yet, Ss in the $A^{S}C/S$ condition recovered quickly and their performance matched that of the Ss in AC/S on subsequent trials.

The second contrast above (AC/PA vs. CD/PA) replicates the findings from traditional PA transfer studies. Inspection of Figure 1 and an interesting, but redundant (i.e., non-orthogonal), comparison for two of the sentence groups (AC/S vs. CD/S) reveals no difference

($\underline{F} < 1$). Note that this is the familiar negative transfer paradigm in sentence context.

A third contrast (Sentence vs. PA paradigms) from the orthogonal set of four was not significant ($\underline{F} < 1$). Again, as in list 1 learning, acquisition was not facilitated by sentence contexts vis-a-vis the non-syntactic PA method. This result is discussed below in connection with the errors analyses.

The fourth comparison that maintained the orthogonality of the set ($AC/S + A^{S}C/S - 2CD/S$) was not significant ($\underline{F} < 1$).

The above analyses show, then, negative transfer in AC/PA relative to CD/PA over the five trials. In the case of the sentence paradigms, however, AC/S and CD/S did not differ and while $A^{S}C/S$ showed negative transfer on Trial 1, this effect dissipated on subsequent trials.

Overall, the results point to the conclusion that an amelioration of effects occurs when the negative transfer paradigm is placed in sentence context. The findings add support to the hypothesis that sentence contexts in both list 1 and list 2 learning act as general list differentiators in transfer.

List 2 Errors. Errors during list 2 learning are summarized in Table 2.

Insert Table 2 about here

Inspection of total errors for an AC/PA vs. CD/PA contrast suggests that any difference between the two paradigms is the result

of greater numbers of misplaced responses in CD/PA. Statistical test was confirming ($F$ = 5.10, $df$ = 1/75, $p < .05$ after arcsine transformation). An identical contrast for misplaced responses in list 1 learning was not significant. The percentages of misplaced response errors in the CD/PA condition remains approximately the same over lists while AC/PA shows a reduction. An explanation is not readily available.

A Sentence vs. PA comparison for the misplaced response measure was significant ($F$ = 4.01, $df$ = 1/75, $p < .05$). The PA paradigms produced a greater percentage of such errors. An identical, and significant, contrast in list 1 learning was reported earlier. At that time, the results of the misplaced response measure were combined with the analyses of the acquisition and total errors measures, and the joint results were used to explain the uncommon finding that the sentence contexts did not facilitate acquisition. A similar interpretation for no difference between Sentence and PA methods in list 2 learning is mitigated by two observations. First, the total errors (mainly response intrusions) in CD/PA remained at a high level relative to AC/PA. Second, the total errors in the sentence conditions--errors that could be ascribed to intralist or interlist intrusions of sentence-context materials--were substantially reduced in list 2 learning.

A major result of this study indicates that negative transfer can be reduced when the learning materials are embedded in sentences.

That proportionally greater reductions in negative transfer can be expected for a design such as A-B, A-$B_r$ awaits test. Also, it would be interesting to know if positive transfer in a paradigm like A-B, A-B' can be enhanced or otherwise changed as a function of sentence contexts.

Another result of this experiment indicates that specific transfer effects are produced when there is a change in the sentence contexts that surround orthographically identical stimuli. A tentative hypothesis attributes the transfer effects to a change in meaning signaled by the modifiers of the stimulus terms; however, it should be noted that in the present experiment there was a concomitant change in the transitive verb to prevent the sentences from becoming anomalous.

A variety of specific transfer effects might result from different kinds of sentence contexts. For example, what might we expect by way of transfer if stimulus or response terms were to undergo a change in grammatical function in syntax?

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## Footnotes

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2. A stimulus intrusion is the use of a stimulus term as response, and a misplaced response error occurs when a response term from the list is given to an inappropriate stimulus.

Table 1

Mean Numbers of Trials to a Criterion of 11/12 and Mean Percentages of Errors in First List Learning

| Paradigm | Trials to Criterion | Intralist Errors | | Total[a] |
|---|---|---|---|---|
| | | Stim. Intr. | Mispl. Resp. | |
| AC/S | 5.25 | 2.6 | 4.0 | 22.8 |
| $A^{S}C/S$ | 5.50 | 1.6 | 6.2 | 20.1 |
| CD/S | 4.69 | 3.5 | 3.1 | 18.7 |
| AC/PA | 5.38 | 2.4 | 10.9 | 17.2 |
| CD/PA | 5.38 | 3.1 | 14.0 | 22.8 |

[a]includes extralist intrusions and for the sentence conditions, intralist intrusions of verbs and adjectives.

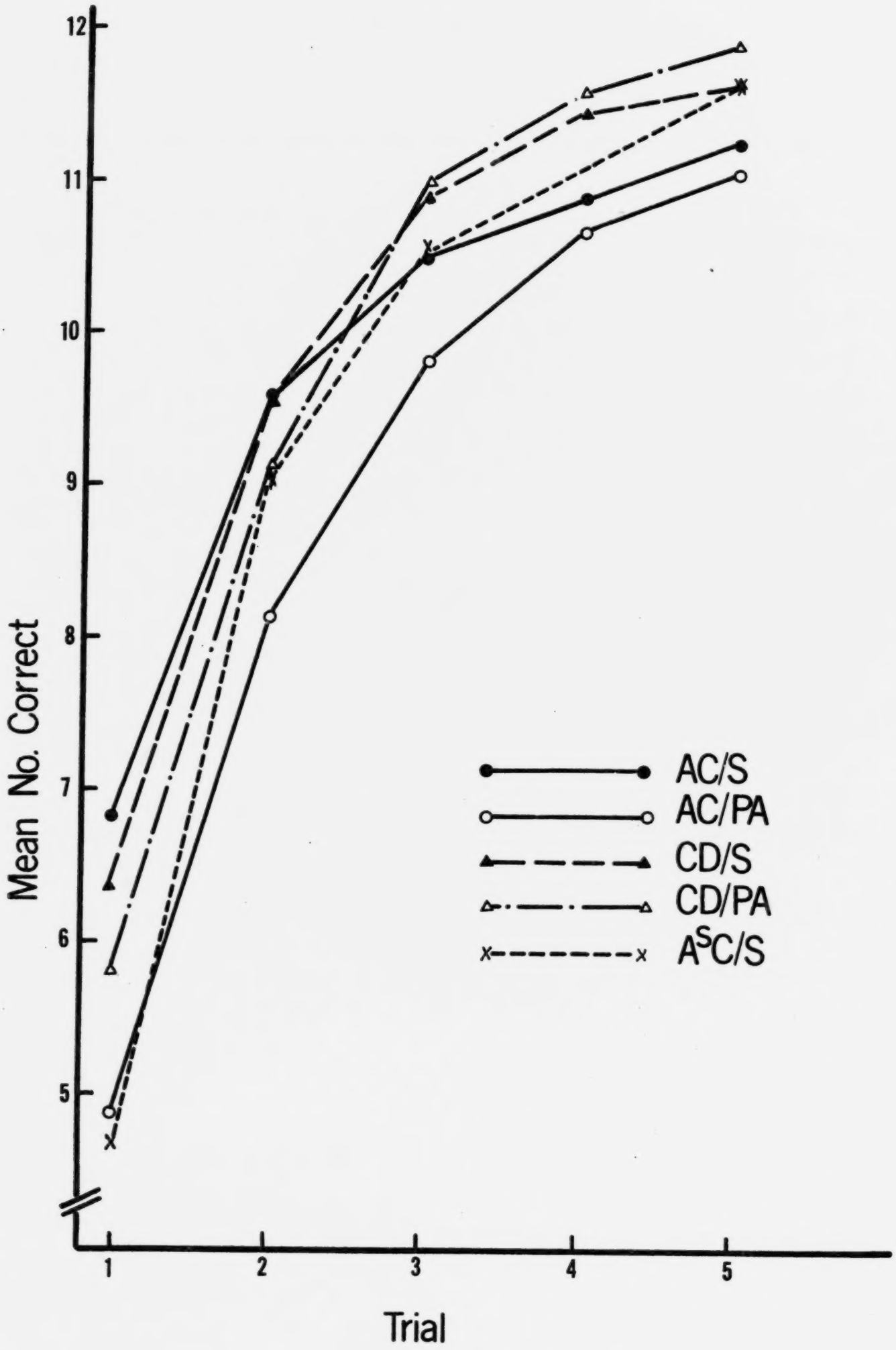
Table 2

Mean Percentages of Errors and Frequencies of Interlist Intrusions in List 2 Learning

| Paradigm | Intralist Errors | | | Interlist Intrusions | |
|---|---|---|---|---|---|
| | Stim. Intr. | Mispl. Resp. | Total[a] | f[b] | n |
| AC/S | 0 | 5.5 | 9.7 | 2 | 2 |
| $A^{S}C/S$ | 0 | 5.3 | 7.7 | 2 | 2 |
| CD/S | 0 | 3.8 | 12.1 | 0 | 0 |
| AC/PA | .9 | 4.7 | 7.1 | 3 | 3 |
| CD/PA | .5 | 12.4 | 16.3 | 2 | 2 |

[a]includes extralist intrusions and, for the sentence conditions, intralist intrusions of verbs and adjectives.

[b]f= frequency of intrusions including adjectives and verbs;
n = number of Ss contributing errors.


12
11
10
9
8
7
6
5
Mean No. Correct
1
2
3
4
5
Trial
AC/S
AC/PA
CD/S
CD/PA
A^SC/S

## Figure Caption

Fig. 1. Acquisition curves for the five experimental conditions in list 2 learning.